

Serial No.: 10/822,358  
Amdt. dated 26 April 2006  
Reply to Office Action of 26 Jan. 2006

### **REMARKS**

As noted previously, the Applicants appreciate the Examiner's thorough examination of the subject application. Claims 1-53 are currently pending in the application. Claims 1-9 have been amended and new claims 21-53 have been added in order to more clearly define applicants' invention. Original claims 10 and 11 are being resubmitted. Claims 12-20 have been withdrawn from consideration pursuant to a previous restriction requirement. No new matter has been added by this amendment.

In the specification, paragraphs [0006], [0008], [0022], [0031], [0034], [0034], and [0038] have been amended for further consistency with the drawings as filed and to remedy minor grammatical issues. No new matter has been added.

Claims 2-5 and 9 have been rejected under 35 U.S.C. § 112, second paragraph, specifically for insufficient antecedent basis for the limitation of "delivery chamber." Claims 1-8 have been rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,565,038 to Ashley ("Ashley"). Claims 1-10 have been rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over U.S. Patent Application Publication No. US 2004/0244837 to Nawata et al. ("Nawata"). Finally, claim 11 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Nawata in view of U.S. Patent No. 6,193,212 to Ohmi et al. ("Ohmi"). These rejections are traversed and reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

### **Election/Restrictions**

Concerning item 1 of the Office Action, the Examiner has acknowledged the Applicants' election of Group I (claims 1-11) as identified the Office Action with restriction requirement mailed 08 September 2005 for the subject application. The Applicants reserve the right to timely file one or more divisional applications directed to unelected claims 9-20.

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### ***Claim Rejections – 35 U.S.C. § 112***

Concerning items 2-4 of the Office Action, claims 2-5 and 9 were rejected under 35 U.S.C. § 112, second paragraph, specifically for insufficient antecedent basis for the limitation of “delivery chamber.”

By the present amendment, claims 2-5 have been amended to delete the word “delivery”, while the chamber has been recited as a “delivery chamber” in claim 9 to provide antecedent basis, thus curing the rejection.

### ***Claim Rejections – 35 U.S.C. § 102/103***

#### ***i. Claims 1-8***

Concerning items 5-7 of the Office Action, claims 1-8 were rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,565,038 to Ashley (“Ashley”).

For a rejection under 35 U.S.C. § 102(b), the cited reference must teach each and every of the limitations of the claim(s) at issue. For a rejection under the 35 U.S.C. § 103(a), the cited reference(s) must teach or suggest each and every of the limitation in the claim(s) at issue. In this situation, Ashley fails to teach or suggest each and every limitation in claims 1-8, and therefore is not a proper basis for a rejection of these claims.

As amended, claim 1 (from which claims 2-8 depend) of the subject application recites the following:

A system for delivering a desired mass of gas, comprising:  
a chamber;  
a first valve controlling gas flow into the chamber;  
a second valve controlling gas flow out of the chamber;  
a pressure transducer providing measurements of pressure within the chamber;  
a controller connected to the valves and the pressure transducer, wherein the controller is configured and arranged to

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- (i) receive a desired mass flow setpoint from an input device;
- (ii) close the second valve;
- (iii) open the first valve;
- (iv) receive chamber pressure measurements from the pressure transducer;
- (v) close the first valve when pressure within the chamber reaches a predetermined level;
- (vi) wait a predetermined waiting period to allow the gas inside the chamber to approach a state of equilibrium;
- (vii) open the second valve at time =  $t_0$ ;
- (viii) calculate a value of the total mass delivered as the second valve is open and as a function of temperature and pressure within the chamber; and
- (ix) close the second valve at time =  $t^*$  when the calculated value of total mass delivered equals the desired mass flow setpoint.

[Emphasis added]

As defined in claim 1, Applicants' recited system include a first (inlet) and a second (outlet) valve and a pressure transducer/sensor that are connected to a chamber and to a controller. The controller is configured and arranged so as to control the operation of the valves so that a precise mass of a gas can be delivered through the second valve. The controller continuously monitors pressure and temperature of the gas within the chamber, calculates the actual mass delivered by the system when the outlet valve is open, and closes the outlet valve when a mass flow set point is reached. As explained by the subject specification, the Applicants' claimed systems provide for the precise and repeatable delivery of quantities (mass) of gas from the chamber. *See, e.g.,* paragraphs[0001], [0012], and [0022] of the specification as filed.

The Examiner relies on Ashley in his rejection. Ashley is directed to removing accumulated films from processing equipment. Specifically, the reference describes introducing an interhalogen gas into a chamber for cleaning purposes. *See* Ashley, col. 4, lines 32-35. The pressure within the chamber is controlled, as is sometimes the temperature. It is submitted, however, contrary to the Examiner's statements Ashley is not concerned with, nor does he suggest the need to determine the exact amount of gas either within the chamber or leaving it. *See, e.g.,* Ashley, col. 9, lines 24-28.

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For the rejection, the Examiner stated that "Ashley is not specific in teaching the operation of his valves with respect to the computer logic and processing claimed in claims 1-8." Applicants agree that Ashley does not teach or suggest operations, computer logic, and/or processing as claimed and contemplated by the Applicants in the subject invention. Further for the rejection, the Examiner stated the following:

In the event that Ashley is not deemed to anticipate Applicant's claimed invention, it would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the operation of the claimed apparatus.

Motivation to optimize the operation of the claimed apparatus is for optimizing the operation of Ashley's apparatus as taught by Ashley (column 8, lines 65-67). Further it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention [Case cites omitted]

Applicants respectfully submit, however, that the cited portion of Ashley does not support the Examiner's stated contention. The cited portion of Ashley states only that "The pressures given above represent the currently preferred embodiment, yet the pressures can be optimized to the user's equipment." Thus, the cited portion of Ashley does not teach or suggest optimization or alteration of the Ashley apparatus to achieve the systems of claims 1-8 (or any other claims) in the subject application so as to deliver a precise amount (mass) of gas from the chamber.

As described above, Ashley in general, and the cited portions in particular, fails to teach or suggest the limitations recited in claim 1, from which claims 2-8 depend. Ashley is therefore an improper basis for a rejection of claims 1-8 under 35 U.S.C. § 102(b)/§103(a), and these claims are therefore patentable over Ashley. The rejection of claims 1-8 under 35 U.S.C. § 102(b)/§103(a) should be withdrawn accordingly, and the claims allowed.

It is noted that new claim 21 recites a system for delivering a desired quantity of mass of gas. The claimed system comprises "a controller configured and arranged to control the inlet and outlet valves so that (a) gas can flow into the chamber until the pressure within the chamber reaches a

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predetermined level, (b) the pressure of gas within the chamber can reach a state of equilibrium, and (c) a controlled amount of mass of the gas can then be allowed to flow from the chamber as a function of a setpoint corresponding to a desired mass, and the temperature and pressure in the chamber.” For the reasons stated above, Ashley does not teach or suggest such a system.

ii. Claims 1-10

Concerning item 8 of the Office Action, claims 1-10 were rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over U.S. Patent Application Publication No. US 2004/0244837 to Nawata et al. (“Nawata”).

Nawata is directed to a pulse shot flow regulator. The system of Nawata measures the volume flow Q of gas exhausted from a cutoff valve based on a difference in pressures within a delivery chamber after the inlet valve is closed, and again after the outlet valve is closed, i.e., at the beginning and end of the delivery process. See Nawata, paragraph [0060]. For the system of Nawata, measurements are made only after a particular gas flow delivery process (or pulse shot) has been completed. See Nawata, paragraph [0061] (“by performing a pulse shot (opening/closing operation of the first cutoff valve 12 and, after that, opening/closing operation of the second cutoff valve 17 once the first and second valves 12 and 17 are in a closed state . . .”). If the mass in the gas flow delivered by the Nawata system is insufficient for required purposes, the only recourse is to correct the error by a subsequent delivery process (pulse shot) as the Nawata system does not measure actual mass delivered by the system.

The Applicants’ claimed systems operate in a fundamentally different manner than the system of Nawata by measuring the mass of gas as it is delivered from the chamber through the outlet valve, with the controller closing the outlet valve at the time the controller determines that the desired amount of mass of gas is delivered. The Applicants’ systems consequently automatically compensate for varying charge pressures, downstream pressures (which affect flow out of the delivery chamber), and orifice geometries and timing characteristics of the inlet and outlet valves,

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while still delivering a desired quantity of gaseous mass.

Similar to the rejection of claims 1-8 over the Ashley reference, the Examiner acknowledges deficiencies in the teachings of Nawata relative to the Applicants' systems recited in claims 1-10, but alleges that such differences would have been obvious to one of skill in the art owing to supposed motivation found in Nawata for optimizing the Nawata apparatus. Applicants respectfully submit, however, that no such motivation is found in the Nawata reference and it is noted that the Examiner did not provide a specific location of any such motivation within Nawata.

Thus, Nawata fails to teach or suggest the limitations recited in claim 1, from which claims 2-10 depend. Nawata is therefore an improper basis for a rejection of claims 1-10 under 35 U.S.C. § 102(e)/§103(a), and these claims are therefore patentable over Nawata. The rejection of claims 1-8 under 35 U.S.C. § 102(b)/§103(a) should be withdrawn accordingly and the claims allowed.

### iii. Claim 11

Concerning item 9 of the Office Action, claim 11 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nawata in view of U.S. Patent No. 6,193,212 to Ohmi et al. ("Ohmi"). Ohmi describes a fluid control valve and fluid supply/exhaust system. The control valve is described as having a response time in the order of several milliseconds. The fluid supply and exhaust system is illustrated in Fig. 3 and described in column 14 of the patent. As described "the system comprises a gas source, flow rate regulator, and a valve, together with devices into which fluid flow from this system." (14:6-14:10) The operation of the system is then described. It is not clear from the description how the text corresponds to Fig. 3, but it is clear that the system is designed to provide both purging and exhaust of gases. This is clearly different from the gas delivery system as claimed by applicants. Thus, applicant does not understand how Ohmi cures the deficiencies noted previously for Nawata.

Consequently, the combination of Nawata and Ohmi fails to teach all of the limitations of claim 11, which is therefore patentable over the cited references. Accordingly, the rejection of claim

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11 under 35 U.S.C. § 103(a) is without proper basis and should be withdrawn.

***Newly submitted claims 21-53***

It is noted that new claim 21, and claims 22-30 which are dependent thereon, recite a system for delivering a desired quantity of mass of gas. The claimed system comprises "a controller configured and arranged to control the inlet and outlet valves so that (a) gas can flow into the chamber until the pressure within the chamber reaches a predetermined level, (b) the pressure of gas within the chamber can reach a state of equilibrium, and (c) a controlled amount of mass of the gas can then be measured and allowed to flow from the chamber as a function of a setpoint corresponding to a desired mass, and the temperature and pressure in the chamber." For the reasons stated above, neither Ashley, Nawata nor Ohmi whether considered alone or in combination teach or make obvious such a system.

New claim 31, and claims 32-33 which are dependent thereon, recite an atomic layer deposition system including a mass delivery control system. The claim system comprises "a mass delivery control system configured and arranged to repeatedly deliver pulses of precisely metered quantities of a precursor gas, each pulse of a desired predetermined mass, to the semiconductor process chamber, wherein the metered quantity of each pulse is measured as the pulse of gas is being delivered to the semiconductor process chamber." For the reasons stated above, neither Ashley, Nawata nor Ohmi whether considered alone or in combination teach or make obvious such a system.

New claim 34 and claims 35-48 recite "An atomic layer deposition system comprising: a mass delivery control system configured and arranged to repeatedly deliver pulses, each of a predetermined mass, of at least one precursor gas to a processing chamber." The mass delivery control system includes: "a controller configured and arranged to control the inlet and outlet valves so that for each pulse of precursor gas (a) gas can flow into the delivery chamber until the pressure within the delivery chamber reaches a predetermined level, (b) the pressure of gas within the delivery chamber can reach a state of equilibrium, and (c) a controlled amount of mass of the gas can then be

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allowed to flow from the delivery chamber as a function of a setpoint corresponding to a desired mass, and the temperature and pressure in the delivery chamber so that a metered quantity of gas is measured as the pulse of gas is delivered to the semiconductor process chamber.” For the reasons stated above, neither Ashley, Nawata nor Ohmi whether considered alone or in combination teach or make obvious such a system.

New claim 49 and claims 50-51 recite “a method of repeatedly delivering pulses of metered quantities of a precursor gas to a semiconductor processing chamber, comprising: repeatedly delivering pulses of precisely metered quantities of the precursor gas, each pulse of a desired predetermined mass, to the semiconductor process chamber; wherein repeatedly delivering the pulses includes measuring the mass of each pulse of gas as each pulse is delivered to the semiconductor process chamber.” For the reasons stated above, neither Ashley, Nawata nor Ohmi whether considered alone or in combination teach or make obvious such a method.

Finally, new claim 52 and claim 53 dependent thereon recite “a method of repeatedly delivering pulses of metered quantities of a precursor gas to a semiconductor processing chamber, comprising: (a) accumulating the gas within a delivery chamber until the pressure within the chamber reaches a predetermined level; (b) waiting a predetermined waiting period to allow the gas within the delivery chamber to approach a state of equilibrium; and (c) measuring the mass of the gas as it flows from the delivery chamber to the semiconductor processing chamber so that a precise metered amount of gas is delivered to the semiconductor processing chamber.” Dependent claim 53 recites that “(a)-(c) [of claim 52] are repeated so that pulses of at least two precursor gases are repeatedly delivered to the semiconductor processing chamber.” For the reasons stated above, neither Ashley, Nawata nor Ohmi whether considered alone or in combination teach or make obvious such a method.

### **Conclusion**

In view of the amendments and remarks submitted herein, Applicants respectfully submit that

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all of the pending claims in the subject application, claims 1-53, are in condition for allowance, and respectfully request a Notice of Allowance for the application.


If a telephone conference will expedite prosecution of the application, the Examiner is invited to telephone the undersigned.

The submittal of this paper is not believed to require a fee. Should any fee be required, however, authorization is hereby given to charge our deposit account, No. 50-1133 for any fees required for the prosecution of the subject application.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

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